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Model-independent evidence for dark energy evolution from Baryon acoustic oscillations

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Abstract

© 2014. The American Astronomical Society. All rights reserved.. Baryon acoustic oscillations (BAOs) allow us to determine the expansion history of the universe, thereby shedding light on the nature of dark energy. Recent observations of BAOs in the Sloan Digital Sky Survey (SDSS) DR9 and DR11 have provided us with statistically independent measurements of H(z) at redshifts of 0.57 and 2.34, respectively. We show that these measurements can be used to test the cosmological constant hypothesis in a model-independent manner by means of an improved version of the Om diagnostic. Our results indicate that the SDSS DR11 measurement of H(z) = 222 ± 7 km s-1Mpc-1at z = 2.34, when taken in tandem with measurements of H(z) at lower redshifts, imply considerable tension with the standard ΛCDM model. Our estimation of the new diagnostic Omh 2from SDSS DR9 and DR11 data, namely, Omh 20.122 ± 0.01, which is equivalent to Ω0m h 2for the spatially flat ΛCDM model, is in tension with the value Ω0m h 2= 0.1426 ± 0.0025 determined for ΛCDM from Planck+WP. This tension is alleviated in models in which the cosmological constant was dynamically screened (compensated) in the past. Such evolving dark energy models display a pole in the effective equation of state of dark energy at high redshifts, which emerges as a smoking gun test for these theories.

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Keywords

cosmology: observations, dark energy, methods: statistical